

NASA SBIR/STTR Technologies

S3.02-8312 - Green Monopropellant Propulsion for Small Spacecrafts



PI: Anatoliy Shchetkovskiy
Plasma Processes, LLC - Huntsville, AL

Identification and Significance of Innovation

Small thrusters capable of providing thrust in the micro- or milli-newton range are needed for a variety of tasks including: insertion into final orbit when micro and nano spacecraft are launched as a secondary payload; orbit change and attitude control; precise positioning control for formation flying; and targeted reentry. Moreover, for larger satellite systems the addition of "microthrusters" can aid in achieving very fine attitude control. Future small spacecraft and constellations of spacecraft need high-precision propulsion requirements, usually in volume- and power-limited envelopes.

Despite the fact that green monopropellant-based propulsion systems are ideal for CubeSat applications, no working microthruster has yet been flight qualified because of the high adiabatic flame temperature and the need for reliable ignition, what difficult to achieve using traditional, granular ceramic catalyst. Plasma Processes' program objective is to design, fabricate and demonstrate a green, high-performance, hot gas chemical propulsion system for Cube Satellites.

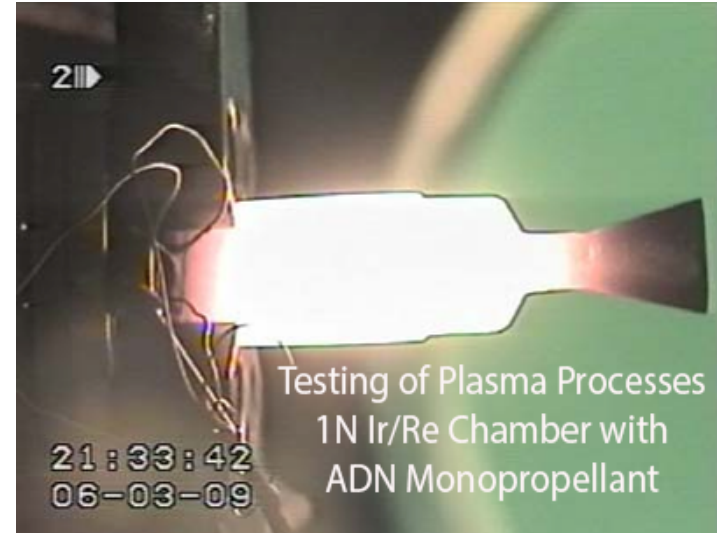
Estimated TRL at beginning and end of contract: (Begin: 3 End: 4)

Technical Objectives and Work Plan

The Phase I specific objectives are as follows:

- Define green propulsion system requirements and critical parameters
- Develop and manufacture a milli-newton oxidation resistant thrust chamber and catalyst bed heater
- Develop and test oxidation resistant fuel injectors
- Fabricate and characterize a monolithic catalyst bed based on iridium foam
- Evaluate the ignition and combustion of AF-M315E and LMP-103S in the microthruster
- Formulate flight weight green propulsion system concepts for small satellites and deliver developed thruster to NASA MSFC for testing at attitude condition and integration in CubeSat 1U module.

The successful completion of Phase I will provide a foundation for the development, manufacture and test of a flight weight, high-performance, advanced green monopropellant propulsion system for Small Spacecraft.



NASA Applications

Potential NASA Applications include small spacecraft and satellite missions requiring Orbit change & Attitude Control, Precision Propulsion, Formation Flying and Target Reentry. Examples of future mission implementation are next-generation Fast, Affordable, Science and Technology Satellite (FASTSAT); Lunar Flashlight; and NEA Scout.

Non-NASA Applications

The technology will provide safe and affordable miniaturized propulsion for the emerging small, micro- and nano-satellite community; and large joint ventures with plans for small satellite constellations providing global internet and mapping. The technology will also benefit low cost launch providers with an increase in payload demand.

Firm Contacts

Timothy McKechnie
Plasma Processes, LLC
4914 Moores Mill Road
Huntsville, AL, 35811-1558
PHONE: (256) 851-7653
FAX: (256) 859-4134

NON-PROPRIETARY DATA